

1 Riser Connector

2
3 Background of the Invention

4
5 This invention relates to a riser connector and
6 method for connecting pipes or risers used to
7 transport fluids, particularly pipes or risers used
8 in the offshore oil and gas industry to transport
9 fluids from well-heads at the sea-bed to the surface.

10
11 Risers can comprise a string of pipes extending for
12 thousands of feet. The connections between the
13 individual pipes need to be secure for structural
14 integrity of the riser, and need to avoid leaking
15 fluids into the sea, and seepage of sea water into
16 the pipe string. Moreover, risers typically need the
17 capacity to bend somewhat to cope with the underwater
18 currents. The bending forces applied to a particular
19 pipe in the string are normally transferred to
20 adjacent pipes via connections between the pipes so
21 that the string as a whole absorbs the force. The

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1 connections between the pipes therefore need to be
2 secure and capable of transferring such loads.
3 Pipes used in such applications typically have a
4 'box' connector at one end and a 'pin' connector at
5 an opposite end. A typical connection is shown in
6 Fig. 1. The pin 3 of pipe 1 is threaded into the box
7 4 of pipe 2 to engage the threads 5, 6 provided on
8 the pin 3 and box 4 respectively.

9

10 To connect the pipes 1, 2 in this way requires a
11 significant amount of torque - typically 50,000
12 ft/lb. on a 10-3/4" riser connector. The pin 3 and
13 box 4 are typically gripped in the pingrip portion 7
14 and the box reaction grip portion 8 respectively as
15 shown in Fig. 2.

16

17 The requirement to transfer forces across the pipe
18 connections means that the threads in the box and pin
19 need to be very close in tolerance, in order to
20 ensure that the riser bends smoothly along its length
21 rather than at the connections between pipes.

22

23 Summary of the Invention

24 According to a first aspect of the invention there is
25 provided a connector for connecting a first tubular
26 to a second tubular; the connector comprising a first
27 portion on the first tubular and a second portion on
28 the second tubular, wherein the first and second
29 portions each have axially extending portions which
30 in the assembled connector are mutually parallel.

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1 Typically the first and second portions have mutually
2 engaging threaded portions. Typically the axially
3 extending portions are unthreaded. Preferably the
4 axially extending portions are load-bearing and allow
5 the transfer of loads between the tubulars.

7 Preferably two axially extending portions are
8 provided on each tubular. Preferably the first
9 axially extending portion on each tubular is greater
10 in length than the second axially extending portion
11 on each tubular. Preferably the axially extending
12 portions on each tubular are provided above and below
13 the threaded portion. Preferably a spigot and a
14 socket comprise the axially extending portions on
15 each tubular. Preferably the spigot is provided
16 between the tubular's threaded face and terminus.
17 Preferably the spigot on the first tubular engages
18 the socket on the second tubular. Preferably the
19 spigot on the second tubular engages the socket on
20 the second tubular.

22 Typically the first tubular comprises a pin
23 connector. Typically the second tubular comprises a
24 box connector. Preferably the socket of the first
25 tubular and spigot on the second tubular are greater
26 in the length than the socket of the second tubular
27 and spigot of the first tubular.

29 Typically the axially extending portions are parallel
30 to the axis of the tubulars, but this is not
31 essential.

1 Preferably the first and second tubulars have a
2 tapered profile. Preferably the tapered portions of
3 the first and second tubulars are the threaded
4 portions of the first and second tubulars and have
5 co-operating tapers to facilitate mating of the two
6 portions.

7

8 Typically at least one seal is provided. Most
9 typically two seals are provided. A first seal
10 typically prevents ingress of fluid (e.g. sea water)
11 from outside the connection of the connector to the
12 threaded and axially extending portions of the
13 connection. A second seal typically prevents fluid
14 (e.g. production fluids) being released from inside
15 the connection to the threaded and axially extending
16 portions of the connection.

17

18 Preferably the seal is formed from differential angle
19 tapers on each spigot and socket, although any
20 sealing means may alternatively be used.

21

22 According to a second aspect of the invention there
23 is provided a method for connecting a first tubular
24 to a second tubular the method comprising the steps
25 of-

26 gripping a first tubular at a position spaced
27 from its terminus;
28 engaging the first and second tubulars;
29 gripping the second tubular; and
30 applying torque between the tubulars.

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1 Typically the first tubular's outer diameter
2 increases near its terminus to form a tapered portion
3 or 'pin'.
4

5 Normally the first tubular's inner diameter remains
6 constant.
7

8 Preferably the first tubular is gripped at a portion
9 before the point that its outer diameter increases.
10

11 Normally the pin has a thread.

12 Typically the second tubular's outer diameter
13 increases near its terminus to provide a receiving
14 portion or 'box'. Normally the box has a thread
15 which can engage the thread of the pin to form a
16 connection between the first and second tubulars.
17

18 Typically the first connector and second connector
19 are also sealed together by any suitable means.
20

21 The portions can simply have an axially extending
22 component and can be deviated slightly from the axis,
23 provided that in the assembled connector they are
24 mutually parallel.
25

26 The length and thickness of the axially extending
27 portions may depend on the length, size or weight of
28 the tubulars connected. Typically the tubulars
29 connected are 45ft long, although they may be, for
30 example, anywhere from 30ft to 90ft long. Typically
31 the first axially extending portion on each tubular

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1 is at least 2" long. Preferably the first axially
2 extending portion on each tubular are 3.5" long.
3 Most preferably the first axially extending portion
4 on each tubular is 6" long. Typically the second
5 axially extending portion on each tubular is at least
6 0.5" long. Preferably the second axially extending
7 portion on each tubular is 1" long. Most preferably
8 the second axially extending portion is 2" long.

9

10 The axially extending portions may be between 0.5t
11 and 3t thick wherein 't' is the thickness of the
12 respective tubular. Preferably the axially extending
13 portions are between 1t and 1.5t thick.

14

15 Brief Description of the Drawings

16 Embodiments of the invention will now be described by
17 way of example only with reference to the
18 accompanying drawings, wherein;

19

20 Fig. 1 is a sectional view of a standard prior
21 art box and pin connection;

22

23 Fig. 2 is a second sectional view of a standard
24 prior art box and pin connection;

25

26 Fig. 3 is a sectional view of a box and pin
27 connection according to the second aspect of the
28 invention;

29

30 Fig. 4 is a sectional view of a box and pin

1 connection according to the first aspect of the
2 invention;

3

4 Fig. 5 is a third sectional view of a standard
5 prior art box and pin connection;

6

7 Fig. 6 is a second sectional view of a box and
8 pin connection according to the first aspect of the
9 invention;

10

11 Fig. 7 is a third sectional view of a box and pin
12 connection according to the first aspect of the
13 invention during assembly;

14

15 Fig. 8 is a sectional view of a thread used in a
16 standard prior art box and pin connection; and,

17

18 Fig. 9 is a sectional view of the thread
19 used in a box and pin connection according to the
20 first aspect of the invention.

21

22 Description of the Preferred Embodiments

23 Referring to the drawings, an embodiment of a
24 connector for pipes in accordance with a first aspect
25 of the invention is shown in Figs. 4, 6, 7 and 9 in
26 which pipes or tubulars 9, 10 each have a threaded
27 pin portion 11 and threaded box portion 12.

28

29 Fig. 4 shows the pin 11 and box 12 portions in their
30 connected position. The pin portion 11 has a spigot
31 13 and a socket 14. The box portion 12 also has a

1 box spigot 15 and a box socket 16. Preferably the box
2 spigot 15 and pin socket 14 have a greater axial
3 length than the pin spigot 13 and box socket 16 as
4 shown in Figs. 6 and 7. Typically the larger box
5 spigot 15 and box socket 16 are at least 3.5" in
6 length and the smaller pin spigot 13 and pin socket
7 14 are at least 1" in length assuming the length of
8 the tubulars 9, 10 is 45ft; the box and pin spigots
9 15, 13 and pin and box sockets 14, 16 are typically
10 proportional with respect to the size and weight of
11 the tubulars 9, 10.

12
13 The box and pin spigots 15,13 are arranged
14 concentrically within the pin and box sockets 14, 16
15 respectively and both the spigots 15,13 and sockets
16 14, 16 are parallel to the axis of the tubulars 9,
17 10, and are thereby adapted to transfer load from one
18 tubular 9, 10 to another. The pin portion 11 and box
19 portion 12 have threads 17, 18 respectively for
20 connecting the pin portion 11 to the box portion 12.
21 Consequently, the threads 17, 18 need not be adapted
22 to transfer radial loads and can therefore be looser
23 than prior art threads used in risers.

24
25 In contradistinction, prior art threads in known
26 riser connectors are shown in Fig. 8. The pin 3 is
27 provided with threads 5 and the box 4 is provided
28 with threads 6. When one of the tubulars 9, 10 moves
29 in any given direction, the radial portion of the pin
30 threads 5 on a first side of the connector transfers
31 the bending load to the other tubular 9, 10 via

2025-10-16 15:01 Murgitroyd Dublin

1 opposite radial portions on the opposite box threads
2 6. Such threads 5, 6 need to be carefully
3. engineered.

5 Certain embodiments of the first aspect of the
6 invention allow the use of far simpler threads which
7 need not be designed to transfer bending loads. Such
8 threads are shown in Fig. 9 and it can be seen that
9 the threads are much looser compared to the prior art
10 threads 5,6 of Fig. 8.

12 The looser pin and box threads 17, 18 respectively
13 reduce manufacturing costs and ease inspection of the
14 tubular connections. The associated savings accrue
15 from all connections in a pipe string to provide a
16 significant cost saving.

18 To form the connection between the pin portion 11 and
19 box portion 12, each pipe is gripped by tongs and the
20 pin portion 11 is inserted into the box portion as
21 shown in Fig. 7. The box socket 16 and spigot 15
22 abut and align the pin portion 11 with the box
23 portion 12 before their respective threads 17, 18
24 engage. Such alignment is a further advantage of the
25 box socket 16 and spigot 15 as threads used in such
26 connectors are prone to damage during this stage of
27 the assembly of tubulars. The pipes 9, 10 are then
28 counter-rotated and the threads 17, 18 engage to form
29 a connection.

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1 Once the connection is made, the box spigot 15 on the
2 box portion 12 engages the pin socket 14 on the pin
3 portion 11. Similarly, the pin spigot 13 on the pin
4 portion 11 engages the box socket 16 on the box
5 portion 12.

6

7 Seals 19, 20 are provided between the pin and box
8 portions 11, 12 respectively. A reservoir seal 19
9 prevents reservoir fluids escaping from the inner
10 bore of the tubulars into the connection. A seawater
11 seal 20 prevents sea water from entering from outside
12 the pipe 9, 10 string into the tubulars 9, 10. The
13 reservoir and sea seals 19, 20 are standard
14 differential angle tapers, with lips on the pin and
15 box portions 11, 12 respectively engaging each other.

16

17 The box and pin spigots 15, 13 respectively and the
18 box and pin sockets 16, 14 allow load transfer
19 between the pipes 9, 10 without requiring the tight
20 threads typical in the prior art.

21

22 When for example, the first pipe 9 is subject to a
23 bending force, the pin spigot 13 and socket 14 of the
24 pin portion 11 abut respectively against the box
25 socket 16 and spigot 15 of the box portion 12,
26 transferring the load to the second pipe 10. Load
27 transfer is indicated by the arrows referenced by
28 reference numerals 21, 22 in Figure 6. Thus bending
29 loads applied to a particular section of pipe are
30 dispersed over the string as a whole by the
31 interaction of the box and pin spigots 15, 13

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1 respectively and the pin and box sockets 14, 16.
2 Consequently a relatively loose thread profile -
3 compared with prior art connectors - may be employed
4 without detracting from the overall integrity of the
5 seal and connection between the pipes 9, 10.
6

7 An embodiment of a connector according to a second
8 aspect of the invention is shown in Fig. 3. As shown
9 in Fig. 3 a first pipe 23, comprises a pin portion 11
10 and a pipe 24 comprises a box portion 12 at a second
11 end of the second pipe 24. The pin portion 11 and box
12 portion 12 have complementary threads 25, 26
13 respectively.
14

15 The pipes 23, 24 are connected by gripping the pipe
16 24 at a box portion head area 28 by tongs and the
17 first pipe 23 at a first pipe area 29 of the first
18 pipe 23. Therefore, the head of the pin portion 11
19 can be much smaller compared with prior art
20 connectors because the pipe 23 is gripped and not the
21 pin head. This reduces the metal required to form a
22 connector without reducing the size of the pin and
23 box portions 11, 12. Moreover, such pipes can be
24 easier to manufacture and further costs can be saved.
25

26 The connection between the two pipes is thereby
27 effected using less material and without compromising
28 the quality of the connection or seal. The numerous
29 connections in a pipe string leads to a significant
30 saving in material, weight, manufacturing complexity,
31 and the cost of the riser.

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